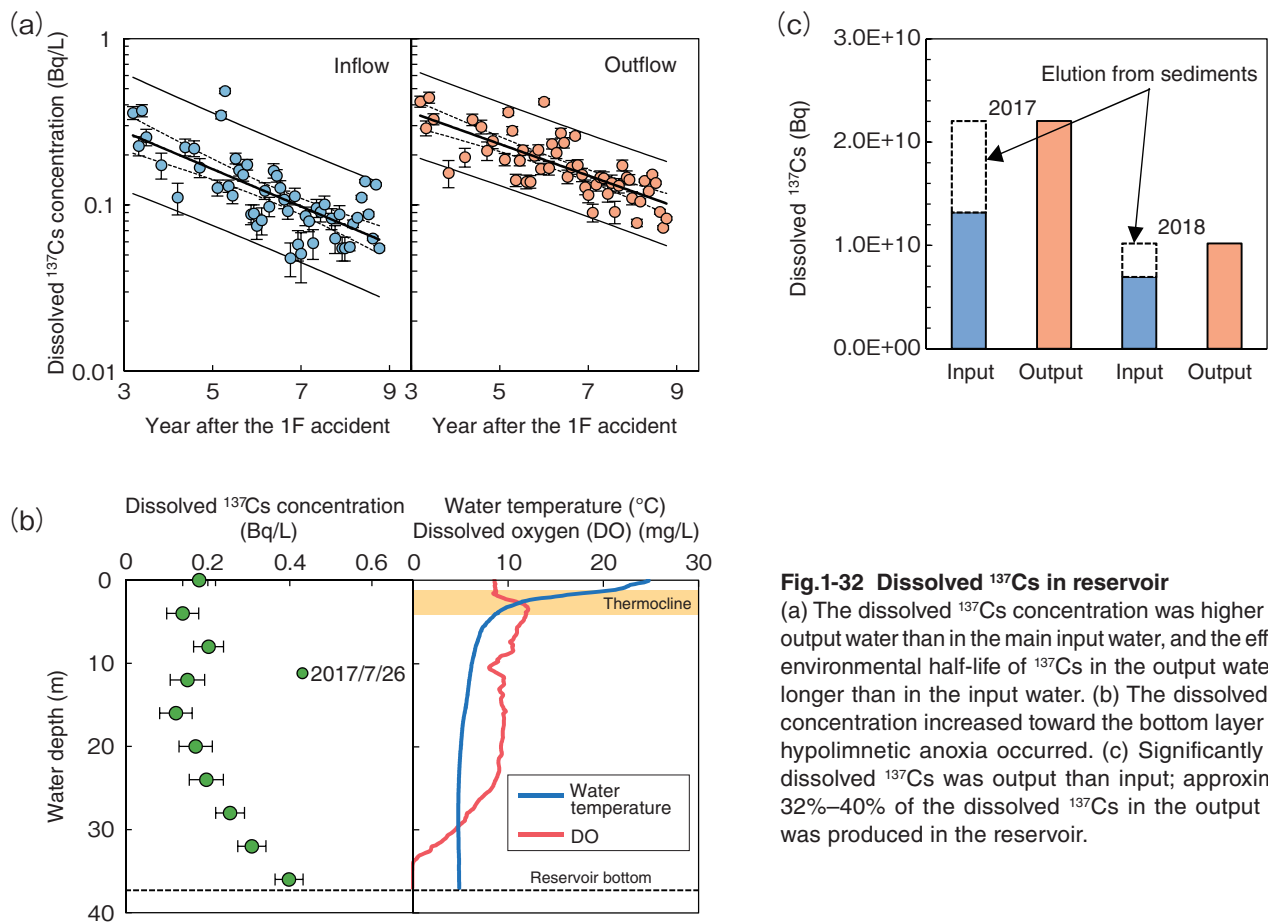


# 1-14 Remobilization of Radiocesium from Sediments

## — Mass Balance of Dissolved $^{137}\text{Cs}$ in an Artificial Reservoir in Fukushima —



**Fig.1-32 Dissolved  $^{137}\text{Cs}$  in reservoir**

(a) The dissolved  $^{137}\text{Cs}$  concentration was higher in the output water than in the main input water, and the effective environmental half-life of  $^{137}\text{Cs}$  in the output water was longer than in the input water. (b) The dissolved  $^{137}\text{Cs}$  concentration increased toward the bottom layer when hypolimnetic anoxia occurred. (c) Significantly more dissolved  $^{137}\text{Cs}$  was output than input; approximately 32%–40% of the dissolved  $^{137}\text{Cs}$  in the output water was produced in the reservoir.

The origins and dynamics of dissolved radionuclides with high mobility and bioavailability in freshwater systems must be clarified to assess their transfer from water to crops and aquatic organisms. To quantitatively evaluate the long-term temporal changes and detail the mass balance of dissolved  $^{137}\text{Cs}$  in the Ogaki Dam Reservoir, which has a catchment with a high  $^{137}\text{Cs}$  inventory due to the accident at TEPCO's Fukushima Daiichi NPS (1F), we investigated  $^{137}\text{Cs}$  concentrations using time series of water input and output samples.

Our results showed that the dissolved  $^{137}\text{Cs}$  concentration was significantly higher in the output water than in the main input water, as shown in Fig.1-32(a). Additionally, the effective environmental half-life of  $^{137}\text{Cs}$  was longer in the output water (3.6 y) than in the input water (2.9 y). Thus, the concentration of dissolved  $^{137}\text{Cs}$  was influenced by the supply from the river input and production within the reservoir (e.g., elution from sediments). The vertical temperature profile showed a stratification with a clear thermocline; hypolimnetic anoxia occurred below a depth of 33 m, as shown in Fig.1-32(b). The dissolved  $^{137}\text{Cs}$  concentration was relatively constant under oxic conditions but increased with depth under anoxic conditions.

These results support the assertion that the  $^{137}\text{Cs}$  concentration gradients in the reservoir water column were caused by the release of  $^{137}\text{Cs}$  from sediment to the overlying water. This mobilization of  $^{137}\text{Cs}$  from the sediment likely results from the ion-exchange displacement of  $^{137}\text{Cs}$  from sediments by cations (e.g.,  $\text{NH}_4^+$ ) released during the anaerobic decomposition of organic matter. We also performed a mass balance of dissolved  $^{137}\text{Cs}$  in the reservoir to elucidate the contribution of dissolved  $^{137}\text{Cs}$  from the river and reservoir sediments to  $^{137}\text{Cs}$  in the reservoir output. The annual output of dissolved  $^{137}\text{Cs}$  was significantly higher than the total dissolved  $^{137}\text{Cs}$  input; approximately 32%–40% of the dissolved  $^{137}\text{Cs}$  output was not input by the river and, thus, likely produced from sediments, as summarized in Fig.1-32(c).

Our results regarding the long-term dynamics and mass balance of dissolved  $^{137}\text{Cs}$  in the reservoir provide important quantitative information for evaluating the catchment's environmental recovery rate and the presence of reservoir sediments containing high  $^{137}\text{Cs}$  levels.

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### Reference

Funaki, H. et al., Reservoir Sediments as a Long-Term Source of Dissolved Radiocaesium in Water System; a Mass Balance Case Study of an Artificial Reservoir in Fukushima, Japan, *Science of The Total Environment*, vol.743, 2020, 140668, 9p.